AN ADAPTIVE CLUSTERING APPROACH TO DYNAMIC LOAD BALANCING AND ENERGY CONSUMPTION OF NODES IN WSN

AHMED SWARA ABBAS AKO

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By:

AHMED SWARA ABBAS AKO

Supervisor: Dr. Kweh Yeah Lun

Thesis submitted to the School of Graduate Student, University Putra Malaysia, in fulfilment of the requirement for the degree of Master of Computer Science

JANUARY 2019

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DEDICATION

I dedicate this thesis to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. I also dedicate this thesis to my family who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish at which I have started. To a special and dear person who has been the source of my strength and has supported me throughout my study with many words of encouragement. To my friends for their endless support. Thank you. My love for you all can never be quantified. God bless you.

ABSTRACT

Abstract of this thesis is presented to the Senate of
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Faculty: Computer Science and Information Technology

Clustering is a well-known approach to cope with large nodes density and efficiently conserving Clustering is a famous method to manage through huge nodes thickness and professionally preserving energy in Wireless Sensor Networks (WSN). A wireless device expedient is a dense battery-activated expedient, accomplished of detecting corporal dimensions of its environs, and distribution available the connected information to a base station. (WSN) contains of a big amount of device nodes occupied cooperatively to attain work.

To establish and maintain the battery powered networks, they are incomplete in relations of dispensation, storage, and communication competences. Contests arise in the application, there are so numerous manageable and irrepressible limitations by which the operation of WSN can be extremely pretentious such as energy preservation.

The appreciated small extent of a device node executes a minor battery by an incomplete obtainable energy inexpensive. Once the wireless sensor network swapped the single function devices, it increased a benefit in the protracted variety of detecting, responsibility broad-mindedness, better-quality exactness and inferior cost than its precursors. In addition, we reflect the tricky of preserving energy through rotating off the node's radio for ages of a immovable time distance in order to project slumber regulator rules that diminish the predictable worth of a price purpose on behalf of both energies ingesting price and holding prices for backlogged packages.

Herein study, we suggest an Energy Effective Adaptive Clustering Protocol with information assembly by means of intra-inter bunch multi-hop message. The intended area is to attain improved cluster extent equilibrium contribution a network topology dispelling least energy. We will use the proposed (HEBM) method to spread the next purposes: plummeting the general network energy consumption (Dispersal the network lifetime period) over balancing the energy consumption between devices nodes and emerging a well-organized hierarchical clustering system in WSN.

KEYWORDS:

Energy consumption, Clustering, WSN, Dynamic Load Balancing, Energy Efficiency.

Abstrak tesis yang dikemukakan kepada Universiti Putra Malaysia sebagai
memenuhi keperluan untuk ijazah Sarjana Kejuruteraan Perisian

AN ADAPTIVE CLUSTERING APPROACH TO DYNAMIC LOAD BALANCING AND ENERGY CONSUMPTION OF NODES IN WSN

Oleh

AHMED SWARA ABBAS AKO

JANUARY 2019

FAKULTI SAINS KOMPUTER DAN TEKNOLOGI MAKLUMAT

Pengerusi: Dr. Kweh Yeah Lun
Fakulti: Sains Komputer dan Teknologi Maklumat

Clustering adalah kaedah yang terkenal untuk menguruskan ketebalan nod yang besar dan memelihara tenaga secara profesional dalam Rangkaian Sensor Tanpa Wayar (WSN). Peralatan perkakasan wayarles adalah suasan bateri yang padat, yang berjaya mengesan dimensi korporat di sekitarnya,

dan pengedaran tersedia maklumat tersambung ke stesen pangkalan. (WSN) mengandungi sejumlah besar nod peranti yang diduduki secara kolektif untuk mencapai kerja.

Untuk menubuhkan dan menyelenggarakan rangkaian berkuasa bateri, mereka tidak lengkap dalam hubungan keterangkatan, penyimpanan, dan komunikasi. Peraduan timbul dalam permohonan itu, terdapat banyak batasan yang boleh diatasi dan tidak dapat ditekankan oleh mana operasi WSN boleh menjadi sangat megah seperti pemeliharaan tenaga.

Tahap kecil yang dihargai nod peranti melaksanakan

bateri kecil oleh tenaga yang tidak lengkap yang murah tidak murah. Setelah rangkaian sensor wayarles menukar peranti fungsi tunggal, ia meningkatkan faedah dalam pelbagai jenis pengesanan, tanggungjawab berfikiran luas, ketepatan yang lebih baik dan kos yang lebih rendah daripada prekursornya.

Di samping itu, kita mencerminkan sukar untuk memelihara tenaga dengan memutar radio nod untuk jarak tak bergerak untuk

untuk menunjuk peraturan pengawal selia yang kurang memuaskan yang mengurangkan nilai yang boleh diramal bagi tujuan harga bagi pihak kedua-dua tenaga memukul harga dan menahan harga untuk pakej berundur.

Di sini dalam kajian, kami mencadangkan Protokol Pengkomputeran Berkesan Energi Berkesan dengan perhimpunan maklumat melalui mesej antar-kumpulan intra-inter. Kawasan yang dimaksudkan adalah untuk mencapai sejauh mana kelompok sumbangan keseimbangan topologi rangkaian membuang paling sedikit tenaga. Kami akan menggunakan kaedah yang dicadangkan (HEBM) untuk menyebarkan tujuan seterusnya: merosot penggunaan tenaga rangkaian umum (Dispersal jangka hayat rangkaian) untuk mengimbangi penggunaan tenaga antara nod peranti dan muncul sistem kluster hierarki yang teratur dalam WSN.

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APPROVAL

This thesis was submitted to the faculty of Computer Science and Information Technology of University Putra Malaysia and has been accepted as partial fulfilment of the requirement for the degree of Master of Computer Science. The members of the Supervisory Committee were as follows:

Dr. Kweh Yeah Lun
Department of Communication Technology and Network
Faculty of Computer Science and Information
Technology University Putra Malaysia

(Supervisor)
Date and Signature

_____

Mrs Sazlinah Binti Hasan
Department of Communication Technology and
Networking

Faculty of Computer Science and Information
Technology University Putra Malaysia
(Assessor)

Date and Signature

_____

DECLARATION

I hereby confirm that:

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LIST OF ABBREVIATIONS

UPM Universiti Putra Malaysia

WSN Wireless Sensor Networ

BS Base Station

NS2 Network Simulator 2

HEBM Hierarchical Energy Balancing Multipath

CH Cluster Head

PCH Primary Cluster Head

LEACH Low-Energy Adaptive Clustering Hierarchy

PEGASIS Power-Efficient Gathering in Sensor Information Systems

MAC Medium Access Control

HMAC Hybrid Medium Access Control

FEMCHRP Fuzzy Energy Efficient Multiple Cluster Head Routing Protocol

DEEAC Distributive Energy Efficient Adaptive Clustering

NTT Network Transmission Time

EMCHRP Fuzzy Energy Efficient Multiple Cluster Head Routing Protocol

Chapter 1
Introduction

1.1 Overview

The focus of this chapter is to review on the adaptive clustering method on Dynamic load complementary and energy consumption of Nodes in Wireless Sensor Networks (WSN) including its definitions, background, the relationship between dynamic load balancing and energy ingesting of nodes in WSN, the methods of measuring energy consumption of nodes in WSN. The review also performed on the role of the dynamic load balancing measurement and how energy consumption of nodes in WSN can be assessed. This topic represented an overall foundation on which further critical analysis was carried out for this study. This chapter will also provide the idea behind our research problem and the manner in which we addressed it, as well as our objective.

1.2 Introduction

Wireless Sensor Networks (WSNs) have achieved great care considering outstanding to widespread variety of requests. Since of these, WSN has remained broadly deliberate [1]. Systems of Wireless Radar strategies are existence organized to collectivity display and distribute data around a diversity of wonders of attention such as light, heat, pressure, etc. [3]. A (WSNs) device is battery- worked device [4] , it contain of large numbers of device nodes occupied cooperatively to accomplish a shared task, which

are deployed in the goal atmosphere to screen bodily and ecological events such as collecting an info from the intensive care area along with dispensation and conveying the gathered information to the base station (BS) which it gather facts after all device nodes then onward them to the close operator, and to become the Intermediary of WSNs interaction with the outside world [5].

In the previous few years, serious research has been procedure by scientists in order to accomplish the collaboration potential among sensors for the work of several functions, including data collection and remote sensing management.

Current raises in scheming these systems has ran to a reduction in sizes, heaviness, and value of these schemes and augmented competence in energy consumption. Meanwhile the imperfect competences of the sensor nodes, WSNs have many restraints. Since the device nodes have limited and non-rechargeable energy capitals, the energy incomes have to be achieved exactly to spread the system generation, one of the main and greatest important challenges in WSNs is the energy feasting tricky, that numerous approaches were planned to over- come this contest [7].

Increasing joblessness of information in WSNs and thus increasing the system prices ،where alike packages must be accumulated and beaten to decrease the conveyed data, (Haupt et al., 2008) proposed a specific criterion for fixing data redundancy problem like as diminishing, exploiting,

or be around , One of the greatest efficient methods to remove the information joblessness is the Compressive Sensing (CS) theory , where this theory integrates both specimen and density in one process, this accomplished by gaging the least amount of examples of indication limited greatest material rather than gathering a big amount of examples , thus the capacity of information is condensed and fewer amount of energy will be expended [8].

Furthermore, unbalanced circulation delivery in WSNs obviously. For instance, in facts gathering procedure, the nodes situated near to the sink consume abundant additional energy than extra devices [8] . This leads to the disturb of load – balancing and system life time reduction [8]. At that case, network performance can improve by using an well-organized cluster-based direction-finding protocol, by collecting the device nodes into the clusters and choosing the conformable Cluster Head (CH), exactly balances the energy consumption in the grid (Wu et al., 2013) [8]. Respectively cluster is self-organized and nearby reductions the data joblessness to accomplish additional permanency network lifetime [8].

New developments in electronic manufacturing have provided the aptitude to enterprise the devices with short control ingesting, minor extent, and sensible value. These devices consume controlled to the arrival of Wireless Sensor Networks (WSNs) [8].

In WSN nodes apply uneven quantity of energy for message and the mandatory energy in rapports of battery influence to convey the pack will vary among the broadcasts with

admiration to the detachment among the despatcher and headset nodes; consequently, multi-hop announcement is recommended. As shown in the scheme below [2].

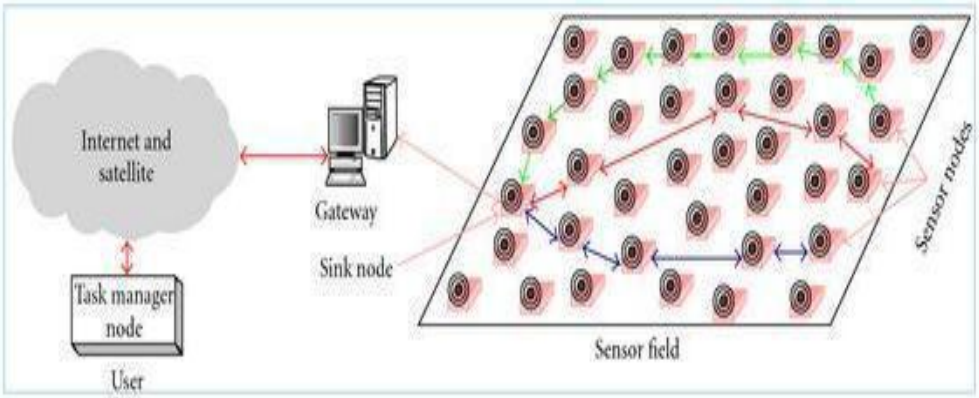

Fig.1.1 Distribution of wireless sensor network

Herein project we suggest an Energy Effective Adaptive Clustering Protocol with information assembly by means of intra-inter bunch multi-hop announcement, Ranked Energy-Balancing Multipath steering procedure for wireless sensor networks: HEBM.

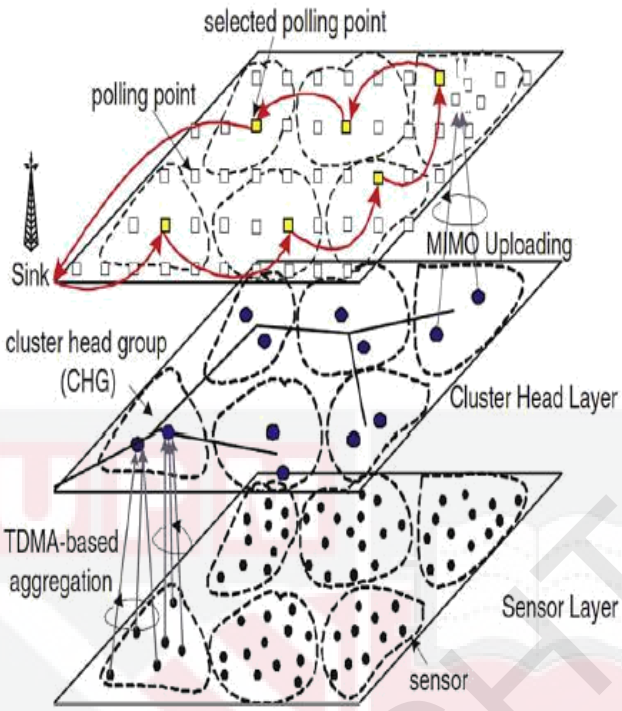

Fig.1.2 showing the transmission in HEBM network [9].

1.3 Clustering Approach for Dynamic Load Balancing

An active weight complementary is obligatory to create load circulation choices founded on the present effort consignment at individually node of the dispersed scheme. Accordingly, it necessity deliver an instrument for gathering and handling classification rank data. The portion of a dynamic load balancing accountable for assembling evidence approximately nodes in the structure is mentioned to as data policy in the works. Also, a dynamic load balancing procedure essential comprise a device to contribution separately node in determining which job is qualified for load balancing. The share of an active load balancing which chooses a occupation for allocation from a resident node to an inaccessible node is devoted to as

transmission policy. Moreover, a dynamic load balancing requirement offer a apparatus on which a terminus node for a moved occupation is strongminded [13]. The share of a dynamic load balancing which chooses a terminus node for a relocated duty is mentioned to as position approach. Thus, a dynamic load balancing has three key mechanisms: the information, transfer, and location strategies. Respectively of these policies will be deliberated in supplementary aspect future. As shown in Fig. 1.3, arriving works are interrupted by the transmission policy which chooses whether or not it would be moved to a distant node for the determination of load balancing. If the transmission policy chooses that a work must be relocated, the position approach is activated in order to discovery a distant node for the work. Evidence strategy affords equally transmission and place approaches with the essential data to shape their results.

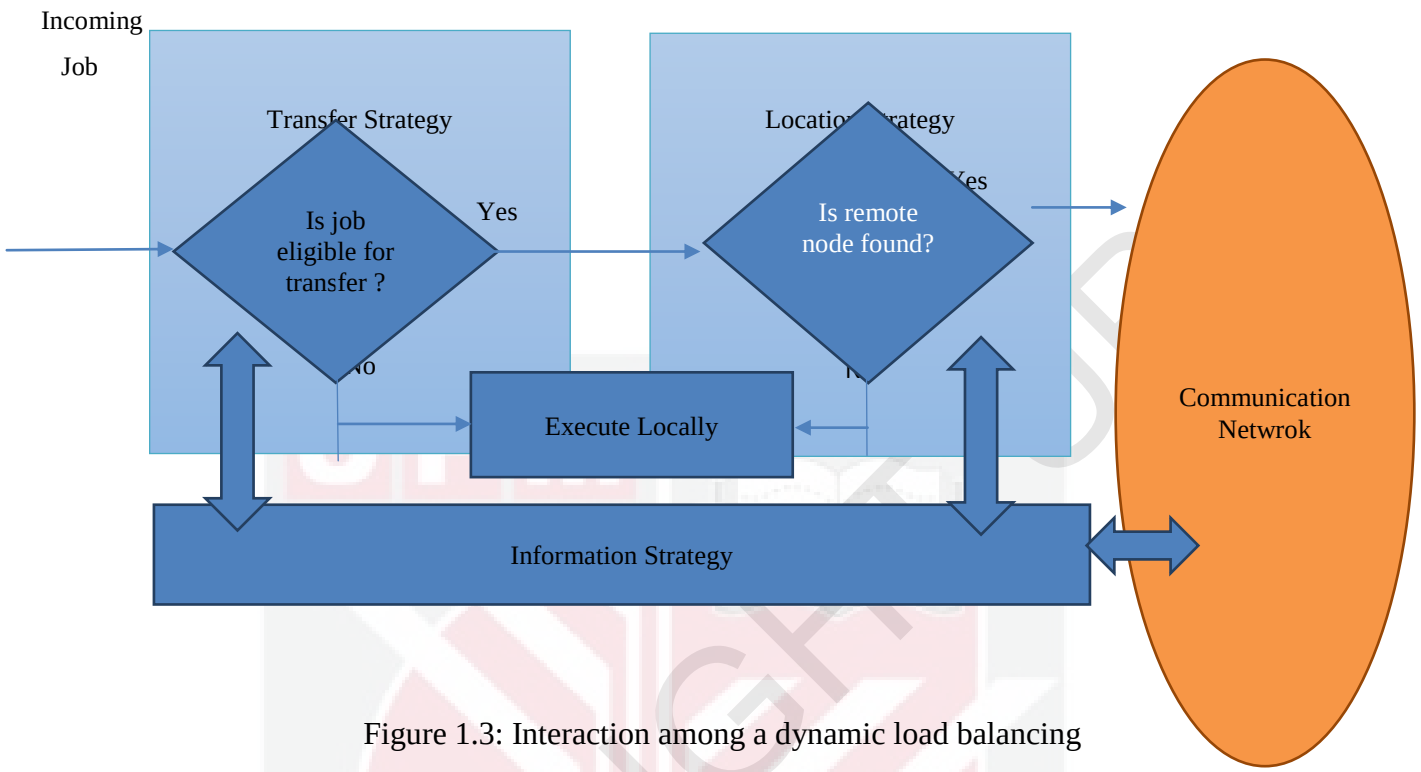

Figure 1.3: Interaction among a dynamic load balancing

1.4 Problem statement

Though nodes are talented to self-organize and cooperate composed so as to found and preserve the system [5], they are battery motorized, imperfect in rapports of dispensation, loading, and statement competences [10]. Contests in wireless device network growth in employment of numerous facilities, there are so numerous manageable and uncontainable limits through which the application of wireless device network exaggerated like as: Energy preservation [6] [10].

By way of we distinguish that the device node has minor scope owing this unimportant extent the cordless has little volume and the accessible energy is actual fewer .When the WSN substituted the solitary instruction sensors, it

expanded benefit in lengthy choice of detecting, responsibility acceptance, enhanced correctness and inferior price than its precursors [3] [9] , Nonetheless by way of the amount of nodes growths in the WSN to upsurge the attention variety and exactness), energy organization develops a main restraint subsequently entirely these nodes are battery motorized . And in that condition the replenishing or substituting of battery is incredible [3] [10].

1.5 Aim of Research

The key determination of this investigation is to investigate and explore an adaptive clustering approach to decrease the general network energy ingesting through dynamic load balancing between device nodes and emerging an effectual ranked gathering structure in Wireless Sensor Networks (WSN).

There is an apparent lack of empirical studies concerning adaptive gathering method to dynamic load balancing. Moreover, to the most excellent of our information, this is the former study to examine the reducing energy consumption of nodes in WSN.

1.6 Research Objective

This research objective is to reduce the complete network energy consumption for spreading lifetime period over dynamic load balancing between device nodes and also emerging an efficient hierarchical clustering arrangement in WSN.

1.7 Research Question

In order to achieve the research objectives, this study guided question about how to reduce the complete network energy consumption for ranging lifetime duration over dynamic load balancing between device nodes and also emerging an effective hierarchical clustering system in WSN?

1.8 Research Scope

This project describes energy consumption and load balancing in wireless sensor network by attain improved cluster size equilibrium and get bunches like that individually has the lowest energy topology dispersing lowest energy. Clustering is an effective method to diminish energy consumption and encompass the life time of the net, A node clustering is self-confessed as an effective method to decrease energy consumption and spread the lifetime of the network, where clustering is an effective technique to decrease energy consumption and range the life time of the network. This liability through information combination and combination in order to decrease the amount of conveyed mails to the Base Station (BS). The network simulator (NS2) will be used to simulate the model.

1.9 Organization of Thesis

The research has five chapter. This first chapter provides a review of Wireless Sensor Networks (WSNs) area through energy consumption with load balancing and short background about this thesis scope. Furthermore, this chapter present the idea behind our research problem and the manner by which we have addressed it. We have also presented the research objective, scope and motivation in this first chapter. Brief description of the remaining chapters is presented below:

Chapter two provides summarization the previous works that were carried out and discussed so as increase the energy efficiency of WSNs

Chapter Three present our motivation to optimize the energy efficiency in WSNs, describes the various techniques used for energy efficiency, Simulations and results of experiments

Chapter 4 discusses about results and analysis. Starts by analyzing respondents including research motivation, implementation environment, nodes energy consumption. The chapter also assesses life time duration of WSN. Furthermore, evaluates the measurement of three protocols comparative analysis. Finally, got the expected results using HEBM Protocol.

Chapter Five present the conclusion of the thesis and upcoming work.

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